Addendum to EIS and IBT Petition to Address Comments from the Environmental Management Commission

PREPARED FOR: NC Division of Water Resources

NC Environmental Management Commission

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DATE: March 2, 2005

Background

This memo is an addendum to the Environmental Impact Statement (EIS) and the Interbasin Transfer (IBT) Petition to the EMC that addresses comments raised by the EMC Water Allocation Committee and EMC during meetings on February 9 and 10, 2005. The EMC approved the subject IBT going forward to public meetings but requested that addendum material be included to specifically address some of the comments. This addendum primarily addresses specific details related to water use forecasts and lake drawdown impacts.

Details of Water Use Forecasts

An extensive population and land use analysis was done by the Water and Sewer Authority of Cabarrus County (WSACC) for its 2002 Water and Sewer System Master Plan (Master Plan) (Black and Veatch, 2002). Concord, Kannapolis, Harrisburg, Mount Pleasant, and Cabarrus County all participated in the master planning process with WSACC and their consultant. The details of this analysis are included as Attachment 1 to this Addendum.

The following briefly addresses the major issues raised relative to water demand forecasts.

Demand Projections - General

For the purpose of the IBT request, projections were based on a 30–year planning period to 2035 based on discussions with DWR and previous IBT actions by the EMC. The Master Plan projected demands to 2050 so the 2035 projections were developed from this information.

Water demands were projected to 2050 based on features of the Cities' and township's service areas including existing and projected land use, past population growth, recent development trends, planned transportation improvements, and changes to the non-residential demands. Three future development scenarios - low, medium and high – were considered through the evaluation. The high development scenario was selected as being the most consistent with historical and planned development trends as well as the planned transportation improvements in the region as outlined in the Appendix.

The Master Plan effort used 2000 use data as a baseline and attempted to minimize influences of the drought on this baseline. This was somewhat difficult since from a water supply standpoint, the area was influenced by some level of drought conditions from mid 1998 until the spring of 2003.

Residential Water Demand

Existing water use data was analyzed by user category. In 2000, ADD was 19.5 MGD for all of the communities, including the residential demand of 8.3 MGD. Residential water use ranged from 68 gallons per capita day (gcd) to 115 gcd, generally on the low end of water use for water systems in North Carolina. Using the communities' historical use data from 1995 to 1999, the relationship of maximum day demand to average day demand was determined to range from 1.2 to 2.2. For the purposes of this planning, a maximum day to average day demand factor of 1.7 was selected. A peak hour demand to maximum day demand ratio of 2.0 was also used.

Non-residential Water Demand

For industrial water use, the assumption for the Master Plan was that the major industrial demand would remain constant through 2050 and the remaining industrial, commercial and institutional (ICI) demand would increase directly proportional to the population increase. The recent closure of one major industrial user has temporarily reduced the non-residential demand. Projections have not been modified to reflect this change because several different potential uses of those facilities are currently under consideration and the facility owners still have access to up to XX [From Wilmer] MGD of water capacity.

Unaccounted for water data was difficult to account for in the WSACC system so an industry average of 10 percent of production was used for the purposes of this analysis.

Impacts to Source Basin

Catawba River Basin

In 2001, modeling was conducted to determine effects from a proposed increase in the Charlotte-Mecklenburg Utilities (CMU) withdrawal rate from the Catawba River Raw Water Pumping Station on Mountain Island Lake. Information on withdrawals, discharges and consumptive use for the entire basin through 2030 was developed by CMU's consultants and Duke Power using the CHEOPS model to predict effects on lake levels, hydropower, and downstream flows. The results from this analysis were used to evaluate the impacts of projected water withdrawals associated with this project. This information was also used in evaluating the impacts of the CMU interbasin transfer which was approved by the EMC in March 2002. More details are also provided beginning on page 2-39 of the EIS.

Duke Power's current license from the Federal Energy Regulatory Commission (FERC) requires them to maintain a minimum daily release of 411 cfs to the free-flowing portion of the Catawba River downstream of Lake Wylie. The only other free-flowing portions of the

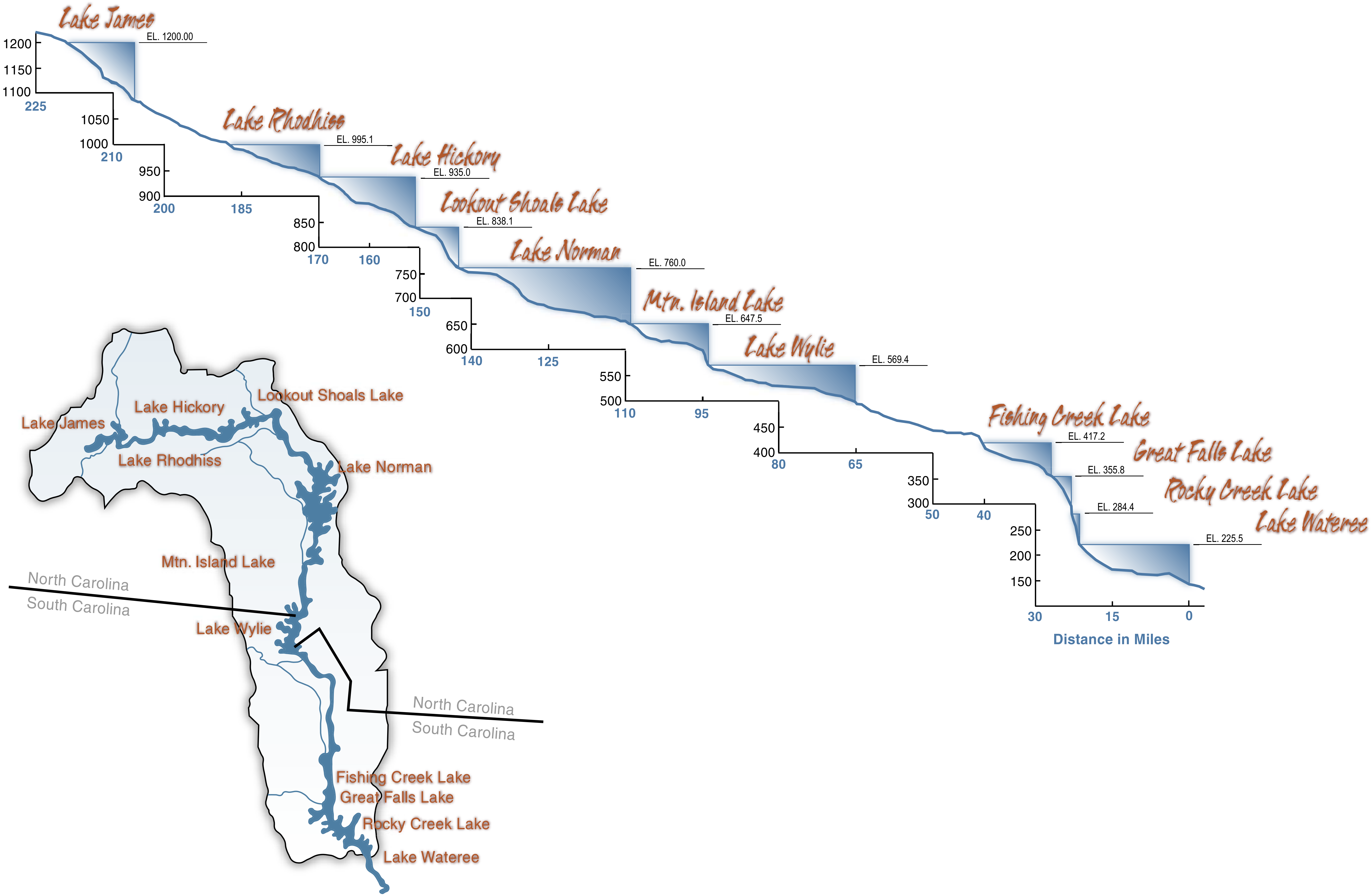


Figure 1: Catawba River System Lake Elevations

Catawba River in North Carolina are upstream of Lake James and between Lake James and Lake Rhodhiss (see Figure 1). The previous amendments to the FERC license for CMU allowed an increase in the peak (instantaneous) rate of withdrawal from Mountain Island Lake from 165 MGD to 330 MGD and an increase in the CMU system average daily withdrawal from 103 MGD (2000 demand) to 163 MGD (2030 demand). The large increase in the peak withdrawal was to allow CMU to take advantage of off-peak utility rates for pumping water to their storage reservoirs.

The information summarized in the EIS focused on the cumulative impact analyses performed for the CMU increase in withdrawal using the Computer Hydro-electric Operations and Planning Software (CHEOPS). The CHEOPS modeling was performed by Duke Power and analysis of the model results were summarized in reports by CMU's consultants (ENTRIX, 2001). The main driver affecting reservoir operations analyzed using CHEOPS was the water not returned to a reservoir as a result of consumptive use. Consumptive water use for this evaluation is the difference between the volume of water withdrawn by water users and the volume of water returned to the river. The principal consumptive water users in the Catawba River Basin are municipal water supply, industry, power plants (cooling water use), and irrigation and agriculture. Interbasin transfers are part of the estimated consumptive use.

The cumulative consumptive use for the entire Catawba River project (i.e. the river basin upstream of the Lake Wateree Dam in South Carolina in 2000) was previously estimated to be 187 MGD on an average basis and this was projected to increase to 250 MGD in 2030 as shown in Table 13 in the EIS (page 2-41). In focusing only on the area upstream of Lake Wylie, the cumulative consumptive use is higher than for the total project because much of CMU's wastewater is returned to the Catawba River, but enters the system through Sugar Creek downstream of Lake Wylie. This return does not count towards meeting the minimum flow requirements downstream from Lake Wylie. The consumptive use for the portion of the basin upstream of the Lake Wylie dam is projected to increase from 243 MGD in 2000 to 339 MGD in 2030 or an increase in consumptive use of 96 MGD. All of these consumptive use estimates are based on average usage.

For the purposes of analyzing the impacts of the IBT from the Cities of Concord and Kannapolis, the average 24 MGD IBT was superimposed on top of the Cumulative 2030 consumptive use and the impacts re-evaluated. The information on lake level effect summarized in Table 12 of the EIS was limited to Lake Wylie to keep the information simple.

Information from the CMU FERC application regarding lake levels (CH2M HILL, 1999) indicated that during an extreme drought the cumulative impact of withdrawal on all reservoirs upstream of Lake Wylie would be 0.5 inches per week. In the EA for the FERC withdrawal, the following information was summarized relative to lake levels.

> *The model results indicate that CMUD 2030 and Cumulative 2030 water withdrawals would have little effect on average pool elevations or the magnitude of water level fluctuations in any of the Catawba-Wateree Project reservoirs, even during drought conditions (Appendix F). This is because of the way the project is operated. Generation throughout the Catawba-*

> *Wateree system would be operated based on maintaining lake levels within certain ranges, and the amount of generation would be reduced in proportion to the withdrawals. This results in less flow through the system, but similar lake levels.*
>
> *The results of our analysis of the effects on lake levels were expected. This is because there are considerable engineering constraints on Duke's lake levels, such as the minimum lake elevations needed to run nuclear and fossil power plants on Lake Wylie and Lake Norman (see Section 3.2.2), as well Duke's need to maintain minimum elevations for efficient operation of the hydroelectric units. The CHEOPS model is designed to simulate the Catawba-Wateree Project to meet these requirements consistent with lake level rule curves, therefore, the model essentially simulates the changes in operation that are made to accommodate the changes in flow.*
>
> *In actual practice, during drought conditions, lake levels may be slightly lower at any given time or reach lower levels sooner with the CMUD 2030 or Cumulative 2030 withdrawal than without (CH2M Hill, 1999), and electric generation would be reduced. However, given the amount of storage in the entire reservoir system, this effect would be relatively small. This is in part attributable to the fact that the impacts on lake levels would be spread across the 11 reservoirs of the Catawba-Wateree system.*
>
> *In rare circumstances, when inflows into the Catawba-Wateree system reach historical drought conditions (about once every 20 years) and the downstream reservoirs reach minimum levels, storage in upstream reservoirs is used as needed to maintain minimum flow through the system. This was the case during the severe drought of 1999 and 2000, yet reservoir elevations did not go below historic levels.*
>
> *Our conclusion is that that CMUD 2030 and Cumulative 2030 water withdrawals would have a minor effect on average pool elevations or the magnitude of lake level fluctuations in most years. During drought conditions, lake levels may reach lower levels earlier, but the normal operating ranges, fluctuation zones and minimum lake elevation would remain largely the same as those that have occurred historically.*

This conclusion from the FERC EA is still applicable to the Concord and Kannapolis IBT because the 24 MGD IBT represents only 7 percent of the consumptive use in the Catawba system upstream of Lake Wylie.

It should also be noted that Duke Power is in the process of conducting a water supply study as part of the FERC relicensing process. This study is updating water use projection through 2050 and re-evaluating many of the input data sets used for the previous analysis. The Division of Water Resources is participating in this study and can provide input to the EMC regarding preliminary results of this effort.

Yadkin River Basin

Some comments were raised relative to the potential impacts of the 10 MGD IBT from the Yadkin River Basin from a combination of the City of Albemarle's intake on Tuckertown reservoir and Badin Lake. In the EIS, impacts associated with a transfer from the Yadkin River Basin were analyzed for several alternative locations (including High Rock Lake) and for alternatives that would meet all of the Concord and Kannapolis water supply needs (up to 24 MGD) from the Yadkin River Basin. These are shown on pages 2-44 through 2-45 of the EIS with additional information in Appendix C of the EIS. The IBT of up to 10 MGD max day from the Yadkin River through Albemarle was considered because it represented a regional solution and provided flexibility in meeting water demands from multiple sources during a drought. The analysis conducted by consultants to ALCOA for the Yadkin River projects indicated that the withdrawals would have less than a 1 percent impact on water available to meet downstream flows. The analysis on lake levels assumed conditions more severe than during the extreme drought of 2002 by examining lake levels under conditions of **no inflow.** Tuckertown Reservoir is the most sensitive to lake level fluctuations. This was the basis for the preferred alternative allowing a transfer from either Tuckertown Reservoir or Badin Lake. Because the ability to transfer water is not dependent on upstream reservoirs (and the analysis was conducted using no inflow from upstream), the proposed transfer will have no impacts on lake levels upstream, which includes High Rock Lake.

The IBT petition included detailed information regarding drought management for the current water supply sources used by Concord, Kannapolis and other Cabarrus County communities. The preferred alternative is a regional solution that will allow Concord and Kannapolis to negotiate water supply agreements with their neighboring communities. When these agreements are in place, the drought management plan will be updated to reflect the additional water supply sources.

Summary

This addendum addresses issues raised during discussions at the February 9, 2005 EMC Water Allocation Committee Meeting and the February 10, 2005 EMC Meeting where they agreed to conduct a public hearing on the proposed IBT coordinated with the public meeting for the EIS for this action. Additional information will be provided in response to comments provided during this public comment process.

References

Black and Veatch, 2002. Water and Wastewater Master Plan for Cabarrus County. Prepared for the Water and Sewer Authority of Cabaruss County.

CH2M HILL. 1999. Request for Increased Maximum Withdrawal Rate at the Catawba River Raw Water Pumping Station. Charlotte, North Carolina.

ENTRIX, 2001. Environmental Assessment for Charlotte-Mecklenburg Utilities Increased Withdrawal from Mountain Island Lake. Catawba-Wateree FERC Project.

Attachment 1

Excerpts from the Water and Wastewater Master Plan for Cabarrus County

(Black and Veatch, 2002)

2.0 – Population and Land Use

2.0 Population and Land Use

Land use and population projections are used as a basis for identifying short-term and long-term water and wastewater needs. This land use and population projection effort is not intended to duplicate or replace land use planning efforts being conducted by the County and the municipalities, but rather to interpret and utilize data for updating of the water and wastewater master plan. The land use and population projection planning team consisted of representatives of the participating local governments and WSACC.

This task included assessment of recent land use and growth patterns in the service area and development of population projections according to location. Projections developed for 2000, 2005, 2010, 2020, and 2050 planning years were used to generate estimates of future water demands and wastewater flows.

Cabarrus County and the portion of adjacent counties within the study area have experienced significant and continuing population growth during the past five years. Development has reflected expansion of both in-county and out-of-county influences; particularly growth pressures from the City of Charlotte and Mecklenburg County.

The planning process consisted of the following steps:

- Assess existing land use in the study area.
- Analyze growth and development data in the study area.
- Review future land use scenarios.
- Estimate future water demand and wastewater flows.

This Chapter discusses land use and population projections. Population was estimated for the pre-established grid system where each tile was projected for the planning horizons. These numbers are presented in Appendix 1. Water demands and wastewater flows generated using these population estimates are addressed in Chapters 3 and 9, respectively.

2.1 Existing Water and Wastewater Service Areas

Existing water and wastewater service is provided to areas of Cabarrus County, which includes the Cities of Concord and Kannapolis and the Towns of Harrisburg, Mount Pleasant, and Midland (recently incorporated). The service area extends northward into Rowan County within the City of Kannapolis and into Mecklenburg County. Wastewater service also extends westward, receiving flow the Highland Creek basin in Mecklenburg County. The study area population is growing rapidly under the influence of both internal economic development and growth pressures from greater metropolitan Charlotte. The existing water service area is shown in Figure 2-1. The existing wastewater service area is shown in Figure 2-2.

2.2 Unified Development Ordinance

One of the important changes in the development environment within Cabarrus County is the proposed Unified Development Ordinance (UDO). The UDO provides for a consolidation of zoning categories among the cities, towns, and the county to simplify and standardize the development process within the County. The UDO also includes requirements for adequate public facilities that will help to ensure that infrastructure is provided concurrently with the future growth of the County. Also included in the UDO is expedited rezoning procedures for specific categories, updates of environmental regulations, identification of new Transit Oriented Development areas, and a new River/Stream designation to provide buffers around rivers and streams. The Cities of Concord and Kannapolis, and the Towns of Harrisburg and Mt. Pleasant have adopted the UDO.

The population projection process addresses growth management issues as reflected in the proposed UDO and provides data to support WSACC and the jurisdictions in cost-effectively providing utility infrastructure. The tools and frameworks developed in this process will facilitate future updates and revisions of the water demand and wastewater flow forecasts as development patterns unfold.

2.3 Assessment of Current Land Uses

2.3.1 Land Use Categories

Data on existing land use patterns and recent development trends were obtained from numerous sources, including the City of Kannapolis Community Development Department, Concord Planning and Community Development, and Cabarrus County Planning Services. WSACC also provided several GIS files, engineering data, and planning data including water and wastewater lines and facilities, the road network, flood zones, rivers, township boundaries, Traffic Analysis Zone (TAZ) boundaries, and other information.

Cabarrus County provided data on recent developments and the number of dwelling units permitted and completed in each development. Additionally, information on housing units by TAZ was obtained. WSACC provided a database of wastewater capacity requests by jurisdiction and project name, which included the amounts of flow requested and used.

These data were augmented with additional information on utility demands outside of Cabarrus County. An ArcInfo Geographic Information System (GIS) was used to compile maps and related geographic data. The GIS provided the capability to analyze mapped information using spatial analysis.

An initial task was to consolidate the zoning categories applied within Cabarrus County to a more generic set of categories for use in master planning efforts. The zoning categories were combined into seven primary categories as shown in Table 2-1.

Table 2-1
Generalized Planning Categories for Master Planning

Generalized Category	Corresponding Zoning Categories [1]						
	Cabarrus County	Concord	Harrisburg (Existing)	Harrisburg (Former)	Kannapolis	Mt. Pleasant (Existing)	Mt. Pleasant (Former)
EX – Excluded from Development		FPO					
AG – Agriculture/ Open/ Rural Residential	AG, RE	AG, RE	RE	RU	AG, RE		
LDR – Low Density Residential	LDR	RL, TND	RL	R20, R20A		RL	R-20, R-12
MDR – Medium Density Residential	RM-2	RM-1, RM-2, RV, MH-1, -2, P	RM-1	R15, R15A	RM-2, RV, RM-1	RV, RM-2, RM-1	R-8
HDR – High Density Residential	RC	RC, PUD, B-1, CC/ TC, O-1, C-1, C-2	O-1	O-A	RC, O-1, B-1, C-1, C-2		
Com – Commercial/Office/ Gen. Business	B-1, O-1, C-1, C-2	CD, AO, PID	B-1, C-1, C-2	B-N, B-G, B-P	C-3, CC, CD	CC, C-1, OI	C-B, G-B
Industrial – Light and Heavy Industrial	I-1, I-2	I-1, I-2	I-1, I-2	I-G, I-H, I-P	I-1, I-2, I-3	I-1	M-1
Others or Unknown		TOD, WSO, HPO					

[1] CU before a zoning category indicates "Conditional Use" (for example CUB-1). If CU precedes a zoning category, use the category following the "CU" (for example B-1).

2.3.2 Current Land Use

At the present time Cabarrus County is primarily zoned agricultural with approximately 130,000 acres so designated. Medium density residential zoning is the second largest category with approximately 60,000 acres. Table 2-2 summarizes acreage according to the generalized planning categories within each of the thirteen townships comprising Cabarrus County. Figure 2-3 is a map illustrating current zoning in the County according to the same summary categories. Development is concentrated along I-85 and in the western portions of the County, as well as near Concord.

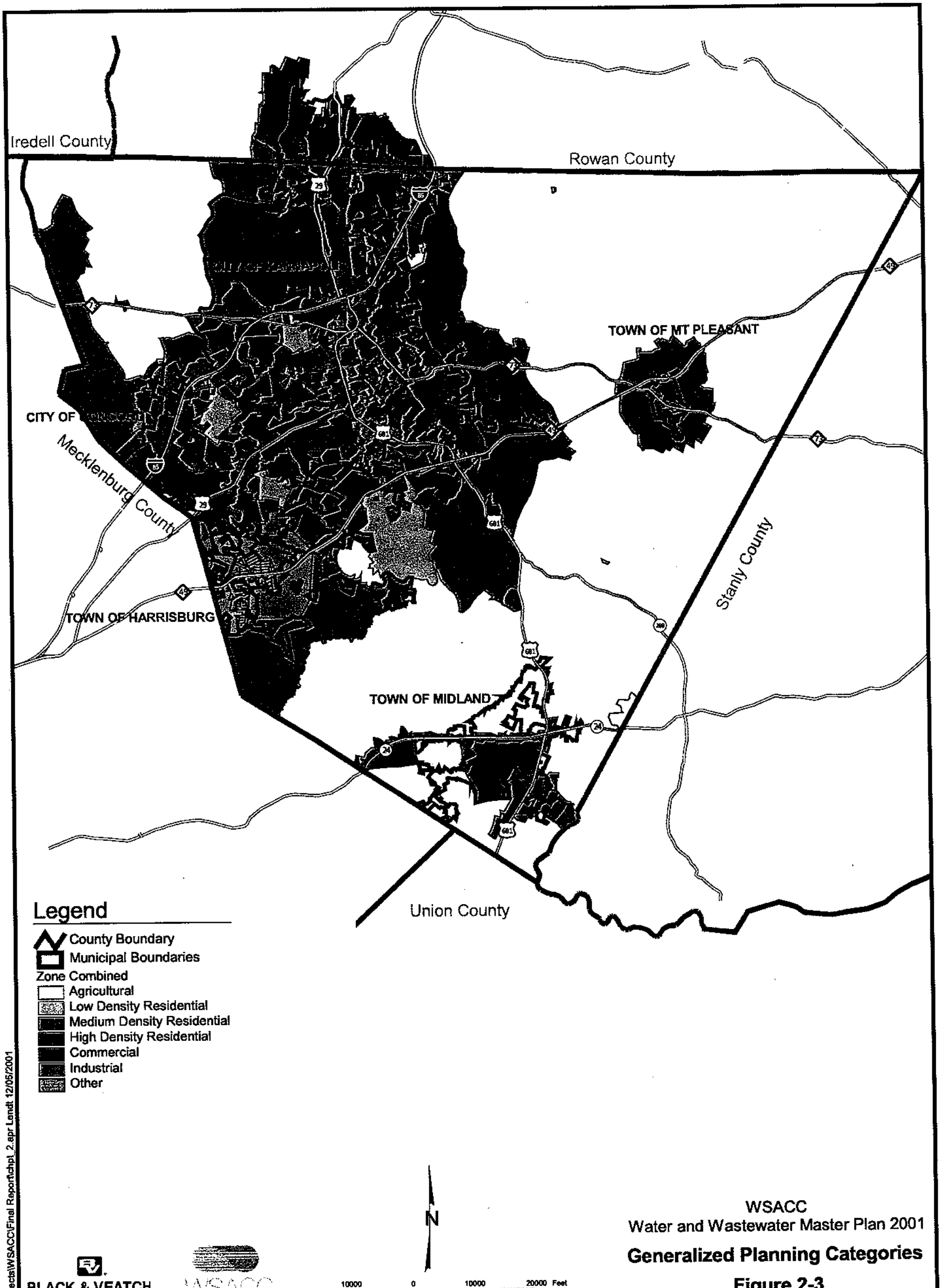
Table 2-2
Zoning Category by Townships Acreage

Township	LDR	MDR	HDR	Commercial	Industrial	AG	Other	Grand Total
Central Cabarrus	633	12,657	1,683	1,593	1,618	742		18,926
Concord		2,867	1,121	568	431			4,987
Georgeville		88			10	18,655		18,753
Gold Hill						17,373		17,373
Harrisburg	2,404	8,896		1,159	1,637	10,895	3,025	28,017
Kannapolis	274	8,979	1,278	4,389	1,223	5,943		22,086
Kannapolis (Rowan)		2,724	94	371	55	4		3,249
Midland		3,723	278	949	1,183	22,748	277	29,157
Mount Pleasant		4,968	90	66	41	14,552		19,717
New Gilead		6,373	5	383	143	8,171		15,075
Odell		3,756		96		14,086		17,939
Poplar Tent	1,298	7,966	1,520	5,837	5,841	1,345	986	24,792
Rimertown					11	16,472		16,483
Grand Total	**4,609**	**62,997**	**6,069**	**15,410**	**12,194**	**130,986**	**4,287**	**236,554**

Note: Source data for the table from a GIS overlay of County zoning provided by Cabarrus County, September, 2000

2.4 Existing Population and Employment Distribution

Several alternative "units of account" were considered to serve as a framework for population and employment distribution. Census tracts, TAZs, School Districts, and the twelve Townships were considered. Additionally, the North Carolina State grid system was available to provide additional smaller unit area information. This grid system resulted in a system of "tiles" covering the entire county based on 10,000 feet (ft) x 10,000 feet (ft) sections. Quarter section (5,000 ft x 5,000 ft) and sixteenth section (2,500 ft x 2,500 ft) tiles provided more detail in urbanized areas, while the full sections were used in the more rural areas of the county. In all, 561 tiles comprised the service area for the population analysis. The location of the existing water distribution system and wastewater collection system, an estimate of the percent development by tile, and the city



WSACC
Water and Wastewater Master Plan 2001

Generalized Planning Categories

Figure 2-3

BLACK & VEATCH
International Company

WSACC

D:\projects\WSACC\Final Report\chpt_2.apr Lendt 12/05/2001 boundaries within the tiles provided the basis for the distributing the present population. The population by tile is provided in Appendix 1. For the Rowan portion of Kannapolis, current population data was provided by the City's Community Development Department.

The population estimates initially focused on the county as a whole. Townships were selected as the next order of magnitude for large area population analysis. The tile system was chosen for the smaller scale spatial area distribution to disaggregate the projected population into smaller areas as required for utility planning. A summary of existing population and employment by agency for the water and wastewater service areas is given in Table 2-3. These numbers were estimated by the committee using arbitrary growth boundaries for future incorporation. The portion of Mecklenburg County, which will have wastewater service provided by WSACC, is also shown in Table 2-3.

Table 2-3
Wastewater Population by Agency

Agency	2000	2005	2010	2020	2050
Concord	65,688	80,164	97,225	133,811	235,643
Kannapolis	40,032	52,778	63,722	86,207	136,587
Harrisburg	3,874	7,390	10,104	17,547	37,616
Mt. Pleasant	3,254	3,590	3,982	4,764	8,441
Mecklenburg County	5,750	24,673	34,746	51,943	122,130
Total	**118,598**	**168,595**	**209,779**	**294,272**	**540,417**

2.4.1 Population and Employment Projection Process

Several factors were considered in the development of population and employment projections for the County. Among these were the historic growth of the County, the growth trends in the metropolitan Charlotte area, projections of future growth by the State, and a comparison with "fast growth" counties in other metropolitan areas. As indicated in Table 2-4, Cabarrus County has experienced nearly a 36 percent population increase in the 1990's.

Table 2-4
Cabarrus County Growth History

	1950	1960	1970	1980	1990	2000
Population	63,783	68,137	74,629	85,895	98,935	134,057
Ten Year Change	N/A	4,354	6,492	11,266	13,040	35,122
10-Year Percent Change	N/A	6.8	9.5	15.1	15.2	35.5
Note: N/A is "Not Available".						

Table 2-5 provides historic population growth data for several rapidly growing counties in other major metropolitan areas. Of particular interest is the ability of these counties to grow in absolute numbers ranging from roughly 30,000 person in a decade to over 100,000 persons in a decade. The important implication for this study is to recognize that as significant as recent rapid growth in Cabarrus County has been, it may not reflect the maximum rate of growth the County will experience as it progresses towards a build-out development condition.

Table 2-5

Selected Metropolitan Area Fast Growth Counties

Area	Change					
	1960-69	1970-79	1980-89	1960-89	10-Year Average	Change 90-99
Atlanta, GA MSA	436,371	453,936	695,375	1,585,682	528,561	1,023,586
Cobb	82,619	100,925	150,027	333,571	111,190	135,796
DeKalb	158,605	67,637	62,813	289,055	96,352	51,016
Gwinnett	28,808	94,459	186,102	309,369	103,123	192,722
Denver, CO PMSA	246,430	322,452	194,144	763,026	254,342	356,011
Adams	65,493	60,155	19,094	144,742	48,247	66,007
Arapahoe	48,716	131,158	98,211	278,085	92,695	90,578
Jefferson	107,848	136,385	66,677	310,910	103,637	70,792
Kansas City, MO/KS MSA	170,844	60,318	132,816	363,978	121,326	189,619
Johnson, KS	76,281	50,196	84,785	211,262	70,421	85,144
Minneapolis–St. Paul MSA	370,606	155,182	326,991	852,779	284,260	407,985
Anoka	68,796	41,286	47,643	157,725	52,575	55,299
Dakota	61,505	54,471	80,948	196,924	65,641	73,904
Portland, OR PMSA	158,323	186,861	134,092	479,276	159,759	605,998
Washington	65,683	87,940	65,694	219,317	73,106	97,751
Richmond-Petersburg, VA MSA	107,673	84,960	104,329	296,962	98,987	95,776
Chesterfield	5,848	64,327	67,902	138,077	46,026	44,091
Henrico	37,124	26,272	37,146	100,542	33,514	26,771

For evaluating alternative approaches for projecting the County's growth, consideration was given to existing projections prepared by other agencies. One set of population projections are those prepared by the State of North Carolina. The State's population projections for Cabarrus County were reviewed and determined to be unrealistically low. It was determined the State's approach tends toward conservative projections due to the limited universal data and statistical indices available from all counties. As such, special development conditions in rapidly growing counties such as Cabarrus County are typically not reflected.

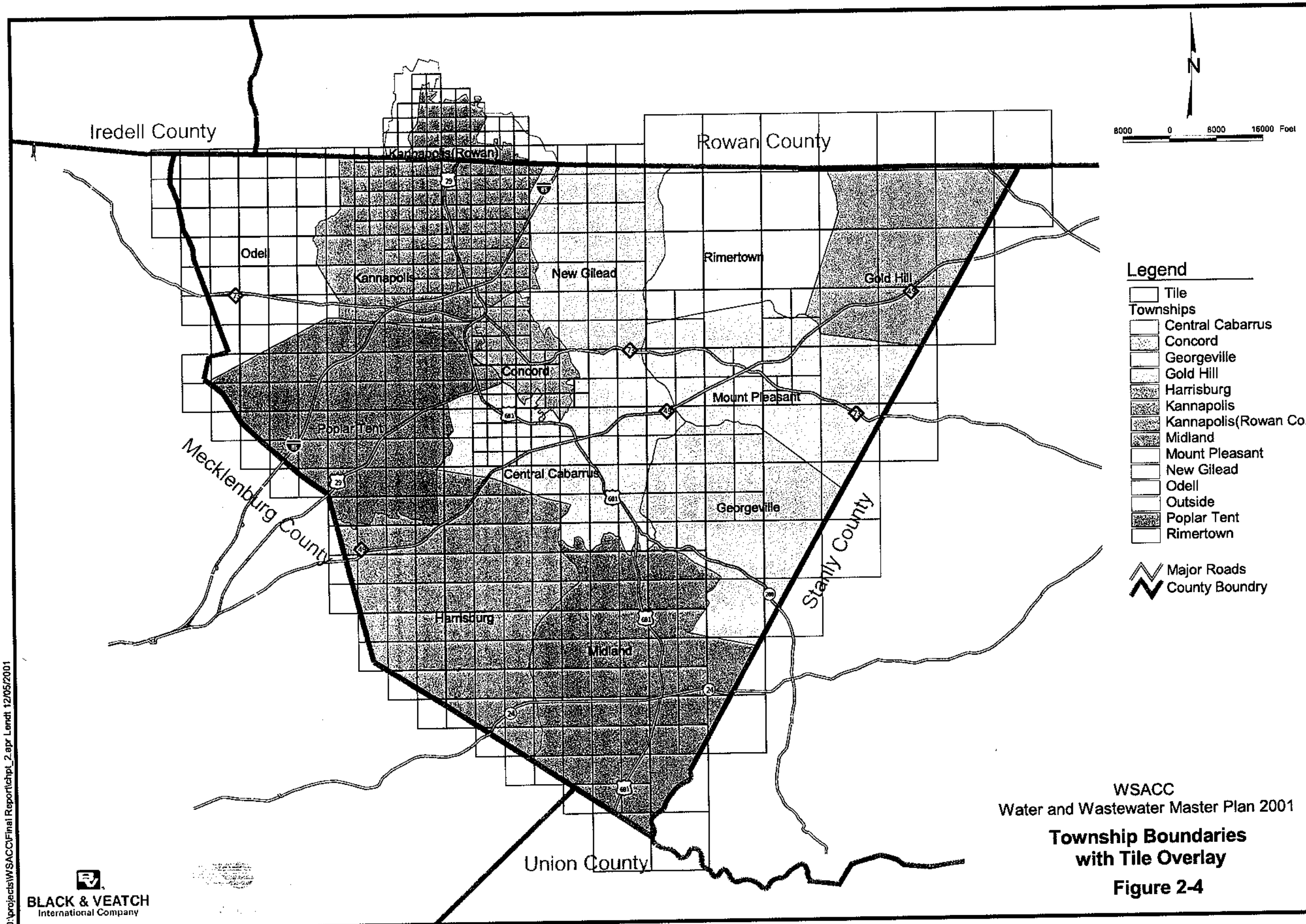
The population projection process involved reviewing both historic and projected future growth. Several alternative methods of managing the population projections were reviewed including incorporating DOT projections as reflected in the TAZ data, using projections by the State and the County, and developing projections for the County's

Townships. Cabarrus County has developed a set of population projections reflecting recent census tract estimates for 2000. The County's updated projections were utilized in the planning process, making use of the new estimates available for 2000, and extended to 2050.

Areas encompassed by township boundaries were selected as a primary intermediate area for forecasting future population and business activities. The township boundaries are depicted in Figure 2-4.

Townships were selected as the base unit for population projections for several reasons. First, the County has used Townships for estimates and projections of population. The County's figures were determined to be the most useful for master planning analysis. Second, the twelve Townships are of a workable size and distribution to provide a basis for population projections. Finally, it was determined that distribution of the County's projections to Townships could be performed in a logical fashion. The Townships provide a useful intermediate step between Countywide projections and the grid-based tile system selected for use in the detailed analysis.

Low, medium, and high development scenarios were considered, with the State projections serving as the low-end scenario. These scenarios are further defined in Section 2.5. The State projections were extended at what was determined to be a moderate growth rate of 6.5 percent per five years planning period to reach the final planning year of 2050. As previously stated, the State projections were determined to be too conservative to be useful for utility infrastructure planning. Table 2-6 summarizes the five-year percentage increases associated with each of the three defined growth scenarios: State, High Growth, and Moderate Growth projections.



WSACC
Water and Wastewater Master Plan 2001

Township Boundaries with Tile Overlay

Figure 2-4

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Table 2-6
Scenario Growth Rate Summary

	5-Year Growth Rates (Percent Change)										
	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
State Projections		7.50	7.40	6.57	6.30	6.50	6.50	6.50	6.50	6.50	6.50
Moderate Growth		25.00	16.00	12.00	10.00	8.00	6.50	6.50	5.00	4.50	4.00
High Growth		25.00	20.00	18.00	16.00	14.00	12.00	10.00	8.00	8.00	6.00

2.4.2 Factors Impacting Growth

Growth scenarios are drawn from factors influencing future development. It was felt that the UDO would have an impact on development in Cabarrus County over the long term. Additional development controls could be adopted in the future as the County continues to urbanize. Additional buffers around identified streams were set aside from development for the future development scenarios reflecting the anticipated desire for measures to preserve open space and environmentally sensitive areas.

Additional restrictions on development contiguous to rivers and streams have been adopted in the form of the River Stream Overlay Zone (RSOZ) in Cabarrus County. The RSOZ requires buffers on each side of streams and rivers, with varying requirements depending on the drainage area of the basin and the anticipated flood prone area around each watercourse. Similarly, new restrictions on development in watersheds of drinking water sources will contribute restrictions on future growth in some parts of the County.

It was deemed appropriate to anticipate that more land will be constrained from development in the future than has been required in the past. These anticipated constraints were reflected by increasing stream buffers and flood zones to approximate these set-aside requirements before the inventory of developable land was established. These adjustments were made at the county-wide level, and resulted in a slight downward adjustment of densities to reflect the increases in undeveloped land. The increased buffer zones were not mapped, but the adjusted densities provide for their presence for the county as a whole.

Other factors influencing development were addressed including the planned creation of a new regional wastewater treatment facility currently identified as the Three-County Water Reclamation Facility. This facility is expected to encourage development in the Midland area. This could spur industrial development opportunities as transportation access is well developed in the Midland area. Offsetting this influence is the recent incorporation of Midland, which reflects, in part, public desires for more growth control.

A major limited access freeway, I-485, is under construction around Charlotte. The section nearest to Cabarrus County is slated for completion in 2003. It was concluded this project would stimulate development on the southwest side of Cabarrus County, particularly in the University City and Midland areas. Interstate 85 is scheduled for widening and additional interchanges are planned through Cabarrus County, which will likely intensify future development along its route.

Other development factors include the County's initiatives to encourage business and industrial growth within the County. A study by others to identify the County's strengths and weaknesses with regard to future growth is currently underway.

A factor impeding growth includes the success of existing business and industry. The County's largest single water and wastewater customer (Pillowtex - Fieldcrest Cannon) is experiencing financial difficulties and has downsized and reduced textile production. Pillowtex, was included in future projections.

2.5 Projections

The moderate and high growth scenarios which utilize the County's data regarding developments likely to come on-line within the next several years were adjusted to reflect the transportation programs discussed above. The two scenarios diverge in the future. The moderate scenario reflects a stabilizing and moderation of growth in the relatively near future. The high growth scenario reflects very rapid growth for a number of years after which a slowing occurs as the County would begin to approach a build-out condition. Table 2-7 summarizes the growth projections for both the high growth and moderate growth scenarios.

Table 2-7
Cabarrus County Growth Projections Summary

	Population Projection by Year					
	2000	2010	2020	2030	2040	2050
Moderate Growth	134,057	194,383	239,479	275,449	308,021	334,757
Change		60,326	45,097	35,970	32,572	26,736
High Growth	134,057	201,384	274,985	351,778	417,491	478,313
Change		67,327	73,601	76,820	65,713	60,822
Difference	0	7,001	35,506	76,329	109,470	143,556

The countywide projections above were then allocated to Townships to provide a spatial framework, which would allow discussion and evaluation of alternative population distribution scenarios. The process started with the adjusted County projections for 2005 and 2010, which had been prepared by Township. The planning team reviewed the factors contributing to growth in the county and developed an initial distribution of population reflecting those growth drivers.

The initial distribution was reviewed and revised several times throughout the process, with the ultimate scenario indicating an earlier growth surge in the western Townships with growth occurring later in the study period as development moves across the county. A spreadsheet database was developed to allocate future increases in population to Townships. Alternatives presented to the Steering Group and Joint Council Members are provided in Appendix 2. The high growth rate scenario was determined to be the most appropriate for water and wastewater planning.

The projections are in five-year increments and reflect assumptions regarding the growth rate of each Township. The twelve Township totals are made to equal the County-wide totals as a control. The process of developing growth rates for each township reflected an analysis of population densities as well as a tracking of "remaining developable acres" within each township.

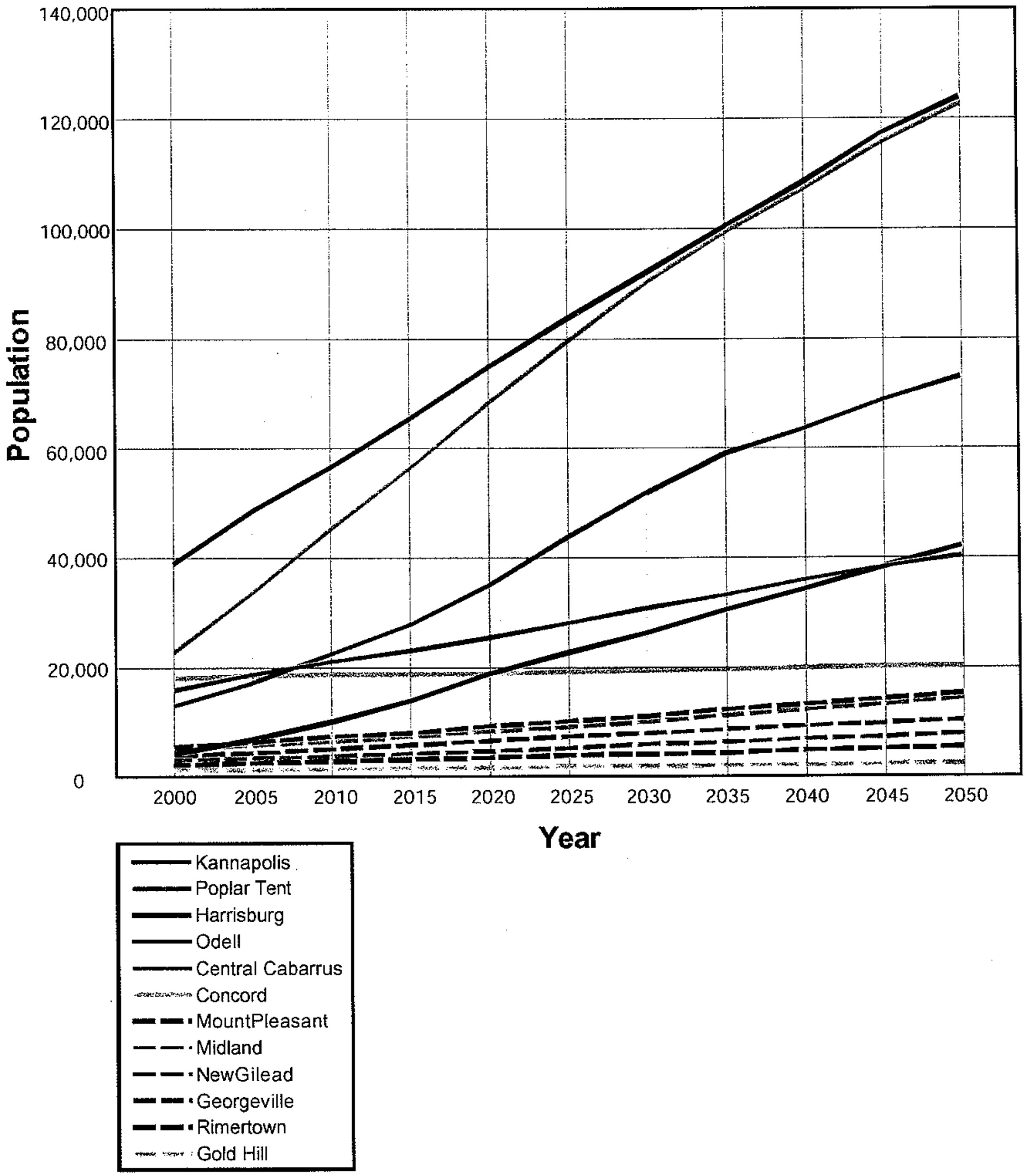
The growth rates and total population figures by Township for the High Growth scenario are depicted in Figure 2-5. Figure 2-5 illustrates projected population by Township between 2000 and 2050. The Kannapolis and Poplar Tent Townships are the most populated in 2000 and remain so to 2050. The Harrisburg Township starts the planning period as the fifth most populated, but finishes as the third largest by 2050 as the impact of improved transportation and utility infrastructure becomes evident. By contrast, the Concord Township exhibits slow growth as it is the most densely developed at the start of the planning period and has the least potential for new growth.

The lesser-populated Townships, mostly on the east side of the county, are projected to retain most of their currently rural nature. This is based on the assumption that the demand for open space preservation is anticipated to increase as the western and central parts of the county develop. For example, in Mount Pleasant most of the growth would likely be concentrated in the town boundaries and adjacent areas while, the preserving the rural character of the remainder of the Township.

Table 2-8 provides the projected population of Cabarrus County by Township through the year 2050. The County is projected to grow from approximately 135,000 persons in 2000 to 478,000 persons by 2050. This is an increase of 3.5 times and reflects a compounded annual average growth rate of about 2.5 percent over the 50-year period.

This analysis concludes the high growth scenario should be adopted for infrastructure planning for three reasons. First, the high growth scenario was determined to be a realistic development scenario given the numerous development drivers impacting Cabarrus County. Second, the high growth scenario includes flexibility in future planning and implementation activities such that WSACC and other service providers will be able to extend the schedule if development is not as rapid as projected. And third, the costs of under planning for infrastructure provision are high relative to the cost of planning more conservatively the first time around.

In short, the population in Cabarrus County is anticipated to double by 2020 and triple by 2040. These projections will provide a foundation for the remainder of the master planning activities, as water demand and wastewater flow are generally anticipated to increase in proportion to population growth.



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High Growth Scenario by Township

Figure 2-5

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Table 2-8
Projected Population by Township High Growth Scenario-Cabarrus County, NC

Township No.	Township	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
1	Harrisburg	8,110	10,626	13,297	17,286	21,607	27,009	33,761	40,514	46,591	52,181	56,356	60,864	64,516
2	Poplar Tent	11,108	16,614	22,504	33,306	44,630	54,895	63,678	72,593	81,304	89,434	95,695	10,393	106,489
3	Odell	3,001	3,672	4,400	6,600	9,570	13,398	18,088	22,609	27,131	30,930	34,641	38,798	42,290
4	Kannapolis	30,659	34,457	38,989	48,736	56,534	65,579	74,760	83,732	92,105	98,552	104,465	109,689	114,076
5	New Gilead	3,365	3,520	3,782	4,539	5,673	7,092	9,219	11,985	14,981	17,977	20,674	23,775	26,152
6	Rimertown	1,743	1,976	2,250	2,520	2,823	3,105	3,416	3,689	3,984	4,382	4,908	5,645	6,491
7	Gold Hill	991	1,119	1,271	1,398	1,510	1,586	1,665	1,748	1,923	2,115	2,327	2,559	2,815
8	Mt. Pleasant	4,733	4,987	5,396	6,205	7,136	7,993	8,952	10,026	11,229	12,576	13,834	15,217	16,739
9	Georgeville	2,178	2,610	3,083	3,546	3,971	4,368	4,805	5,286	5,814	6,396	7,035	8,091	9,304
10	Midland	4,123	4,584	5,057	6,322	8,218	10,273	12,122	14,304	16,450	18,917	21,755	25,018	28,020
11	Central Cabarrus	11,922	13,826	15,979	18,855	21,118	23,230	25,553	28,108	30,919	33,392	36,064	38,949	41,286
12	Concord	17,002	17,216	18,048	18,409	18,593	18,779	18,967	19,156	19,348	19,541	19,737	19,934	20,133
	County Total	**98,935**	**115,206**	**134,057**	**167,722**	**201,384**	**237,306**	**274,985**	**313,749**	**351,778**	**386,395**	**417,491**	**450,932**	**478,313**

2.6 Spatial Distributions

Within the planning years (2000, 2005, 2010, 2020, and 2050), the population was distributed to the North Carolina Grid system tiles within the townships using the county-wide and twelve township population projections as controls. Existing percent development within the tiles in 2000 served as the basis for assigning present population to a tile area. Successive assignments of population in the future planning years were in accordance with the growth generators and the township controls.

The reasonableness of the population distributions was evaluated by several means. During the iterations of the distributions, the 2000 population within the incorporated cities was compared to their actual populations. This was the primary mechanism to verify that existing development was properly accounted for. Adjustments were made to specific tiles on the basis of the interpretation of the development drivers while holding the individual township projected population firm as a control.

The final allocation of population within the tiles for the planning years is provided in Appendix 1.

2.7 Service Areas

The population distribution by tiles is the basis for describing the population within the water and wastewater service areas. A spatial relationship was developed that associated the tile populations with the geographic boundaries of the pressure zones and the drainage basins. By aggregating the tile populations within the boundaries, future Cabarrus County and agency service area populations for the planning years were developed. Mecklenburg County populations were derived from drainage basin acres and projected population densities of adjacent Cabarrus County tiles and available engineering reports.

The water and wastewater service area boundaries abut each other in the core urban areas of Concord, Kannapolis, Harrisburg, and Mount Pleasant. The water and wastewater service areas will be the same in the future. Outside Cabarrus County, the water service area has a Rowan County component within the existing Kannapolis City boundary and future expansion area. Wastewater drainage basins extend over a larger geographic area than the water service areas and extend into Mecklenburg County to the west as well Rowan County to the north. This expanded service area generates a greater population for the wastewater. These areas are discussed in the following sections.

2.7.1 Water Service Area

The existing geographic boundaries of the service areas and pressure zones for the water jurisdictions served as the basis for the initial allocation of population. Both Kannapolis and Concord have agreed upon future service area expansion boundaries, accounting for the majority of the service area growth. Figure 2-6 shows the existing pressure zones as well as the future limits of service for the planning years.

Concord and Mt. Pleasant are negotiating the service boundaries in 890 pressure zone. It is logical that Mt. Peasant's service extend to the west to Walker Road. An agreement would have to be reached with Concord to compensate them for the infrastructure they have installed.

People within the existing service area boundaries were assumed to receive water service from the water jurisdictions and would continue to do so through 2050. Those outside the existing service boundaries were assumed to get water delivery from either a private utility or from private wells, they were not a part of the water service population calculation for the Year 2000 and were assumed to remain on private service through 2050.

Growth beyond the existing service boundaries in Year 2000, but within the future service boundaries, was tabulated for planning years 2005 and beyond. Population living beyond any of the future service boundaries was not counted in the future water service population. Kannapolis populations in Rowan County (existing plus future) are included in the totals. Table 2-9 summarizes the water service area populations for the planning years.

Table 2-9
Water Service Areas Population Projection

Entity	Boundaries	Planning Years				
		2000	2005	2010	2020	2050
Concord[1]	Existing (2000) Boundaries	52,149	58,880	66,093	79,641	115,077
	Growth (includes Midland area)	13,539	21,284	31,132	54,170	120,566
	Subtotal	65,688	80,164	97,225	133,811	235,643
Kannapolis	Existing (2000-Cabarrus) Boundaries	30,906	39,886	47,183	61,249	90,757
	Existing (2000-Rowan) Boundaries	9,126	9,856	10,496	10,916	11,353
	Growth		3,036	6,043	14,042	34,477
	Subtotal	40,032	52,778	63,722	86,207	136,587
Harrisburg[2]	Existing (2000) Boundaries	3,874	4,403	4,938	6,357	9,001
	Growth	6,328	9,315	11,494	17,518	34,943
	Subtotal	3,874	7,390	10,104	17,547	37,616
Mt. Pleasant[1]	PZ 807 (surrogate for present + future)	3,254	3,590	3,982	4,764	8,441
	Total	**112,848**	**143,922**	**175,033**	**242,329**	**418,287**

[1] Population projections for Concord and Mt. Pleasant may change depending on the outcome of negotiation of the service boundary.
[2] The 6,328 population in Harrisburg area for 2000 is not properly served for water. The incremental growth each planning year above the 6,328 population will be served in the future.

2.7.2 Wastewater Drainage Basins

Within Cabarrus County, only Black Run Creek basin in the far northeast is not projected to be provided with any public sewer services in the future. The wastewater drainage basins are shown in Figure 2-7. In addition to growth within Cabarrus County, several areas outside the county expand the future wastewater service area and increase the resulting flow contributions.

2.7.3 Mecklenburg County

WSACC currently provides wastewater service to the Highland Creek development. Wastewater interceptors are in design and/or under construction that will deliver additional flow generated in Mecklenburg County to the Rocky River Regional WWTP (RRRWWTP) by 2005. Generally, each of these new interceptors will collect existing wastewater currently pumped and treated within Charlotte-Mecklenburg Utilities facilities. The interceptors will also provide for future growth within Mecklenburg County. In the northwest portion of Cabarrus County, these interceptors will collect wastewater flow from the South Prong (West Branch), West Branch, and Clarke Creek tributaries of Rocky River, eliminating the need for wastewater pumping stations in the Towns of Huntersville and Davidson that currently pump flow over to the McDowell Creek basin in Mecklenburg County. New interceptors along Reedy and McKee Creeks in Mecklenburg County will also collect wastewater in that growing area as tributary flow to RRRWWTP.

2.7.4 Three County Water Reclamation Facility

Planning is proceeding for the Three-County Regional WWTP to be constructed on the Rocky River in Union County to the south. This will have several impacts to the development of wastewater flows within Cabarrus County. The 75,000 gpd Muddy Creek WWTP could be decommissioned and wastewater will flow downstream for treatment when the Three-County plant is operational. This will also provide a gravity alternative for wastewater flows generated downstream of the RRRWWTP in Muddy Creek, Anderson Creek, and Lower Rocky River basins in the near future with Dutch Buffalo Creek basin being a gravity option on the more distant planning horizon. If the Three County Regional WWTP is delayed beyond when the flow to Muddy Creek WWTP reaches 75,000 gpd, improvements and expansion of the plant will be necessary.

2.7.5 Wastewater Service Area Population

The Cabarrus County (including the Kannapolis portion in Rowan) wastewater service area population is derived from the tile population within the geographic boundaries of the drainage basins. An assumption was made that future customers who require water service would generally receive sewer services. Therefore, a cross reference was made with the water service area boundaries (both present and future growth) to use as the basis for those areas which will receive sewer services within the drainage basin.

The Reedy and McKee Creek basin population within Mecklenburg is derived from the preliminary engineering report for the new interceptor design prepared by others for Mecklenburg County. Assessments were made from that data regarding the timing of future hook-ups as well as estimating those customers served by existing private service companies that would continue using those services and not the WSACC interceptors.

The existing Highland Creek population was estimated from Homeowner Association information. Future northwest Mecklenburg County populations were estimated for the Clarke Creek, South Prong, and West Branch tributaries of Rocky River using actual basin acreage with population densities of the adjacent areas in Cabarrus County extrapolated from the tile allocation.

3.0 – Existing and Projected Water Demands

3.0 Existing and Projected Water Demands

Existing and projected water demand information is required for development of long-range CIP plans. Forecasting water demand is a function of the anticipated growth within the service area and the rates at which various categories of customers use water. This chapter describes the methodology and assumptions used to establish the existing and projected future water demands within the Study Area and how those demands are allocated to the hydraulic model nodes.

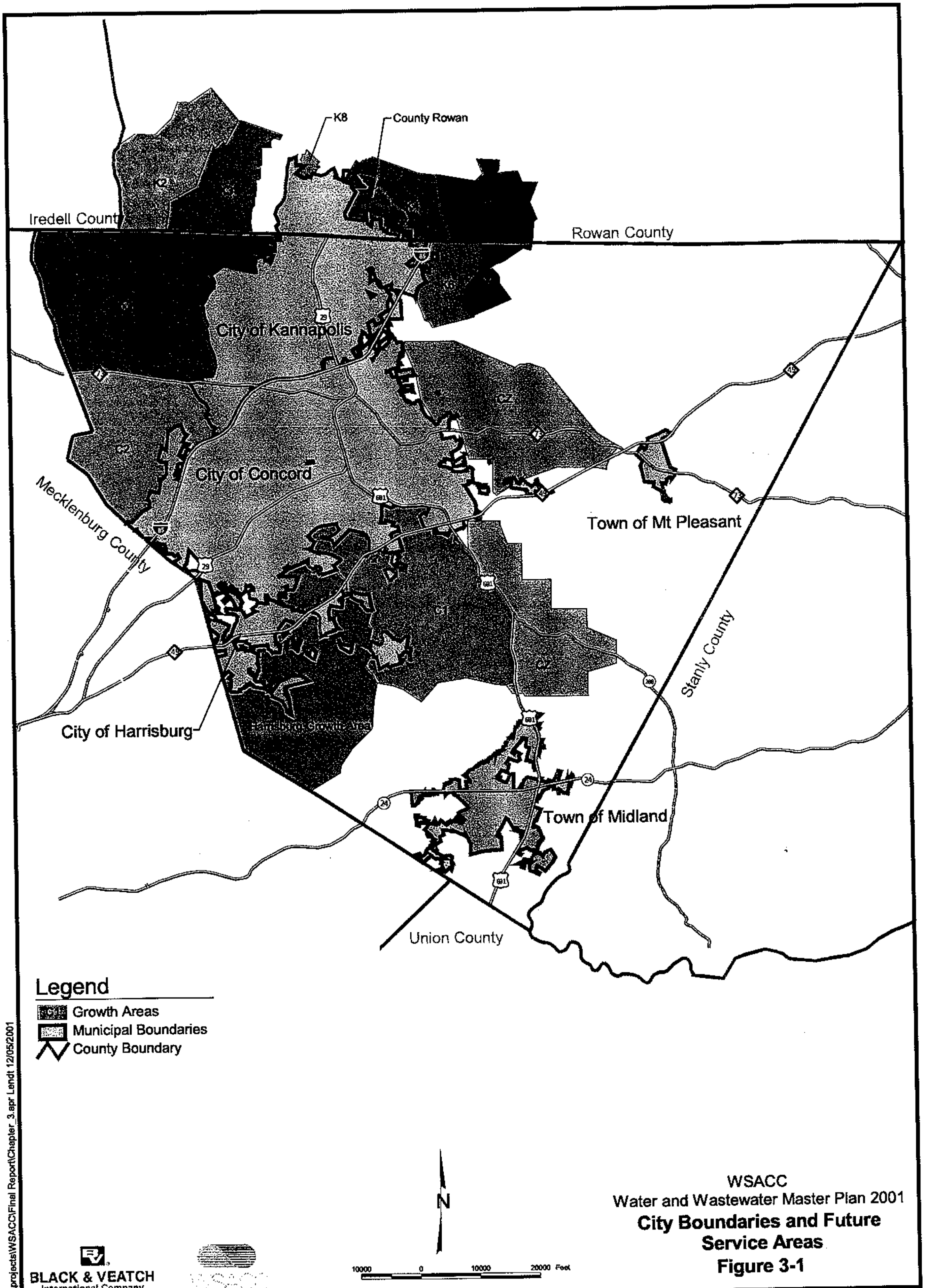
A detailed analysis was conducted of population growth by tiles and was presented in Chapter 2. An evaluation of historical water use characteristics was applied to the population analysis to derive projected water projections. The methodology used to allocate these demands onto the model nodes is described in this chapter. This methodology preserves the current water use characteristics by service area and reflects the growth projected by each tile. This detailed demand allocation methodology enabled the evaluation of future improvements to identify transmission mains and to pinpoint needed distribution piping improvements. These future improvements are evaluated in Chapter 8.

3.1 Study Area

The study area for the demand analysis is shown on Figure 3-1 and consists of the existing city boundaries within Cabarrus County and the growth areas identified by each of the cities. The study area includes the City of Concord, the City of Kannapolis, and the Town of Mt Pleasant and the Town of Harrisburg. The growth areas consist of geographic areas named "C1," "C2," and "CZ" for the City of Concord, and the "Harrisburg Growth Area," and areas "K1" through "K8" for the City of Kannapolis, as shown in Figure 3-1.

3.2 Development of Existing and Future Demands

The approach used in developing existing and future demand is summarized on Figure 3-2. This methodology applies population projections for 2005, 2010, 2020, and 2050 to per capita water use factors to project water demand. A baseline water use for the year 2000 is derived from actual billed water use and water production data from the past five years. The baseline and projected water demands are distributed spatially throughout the existing water distribution systems using the service meter locations.



WSACC
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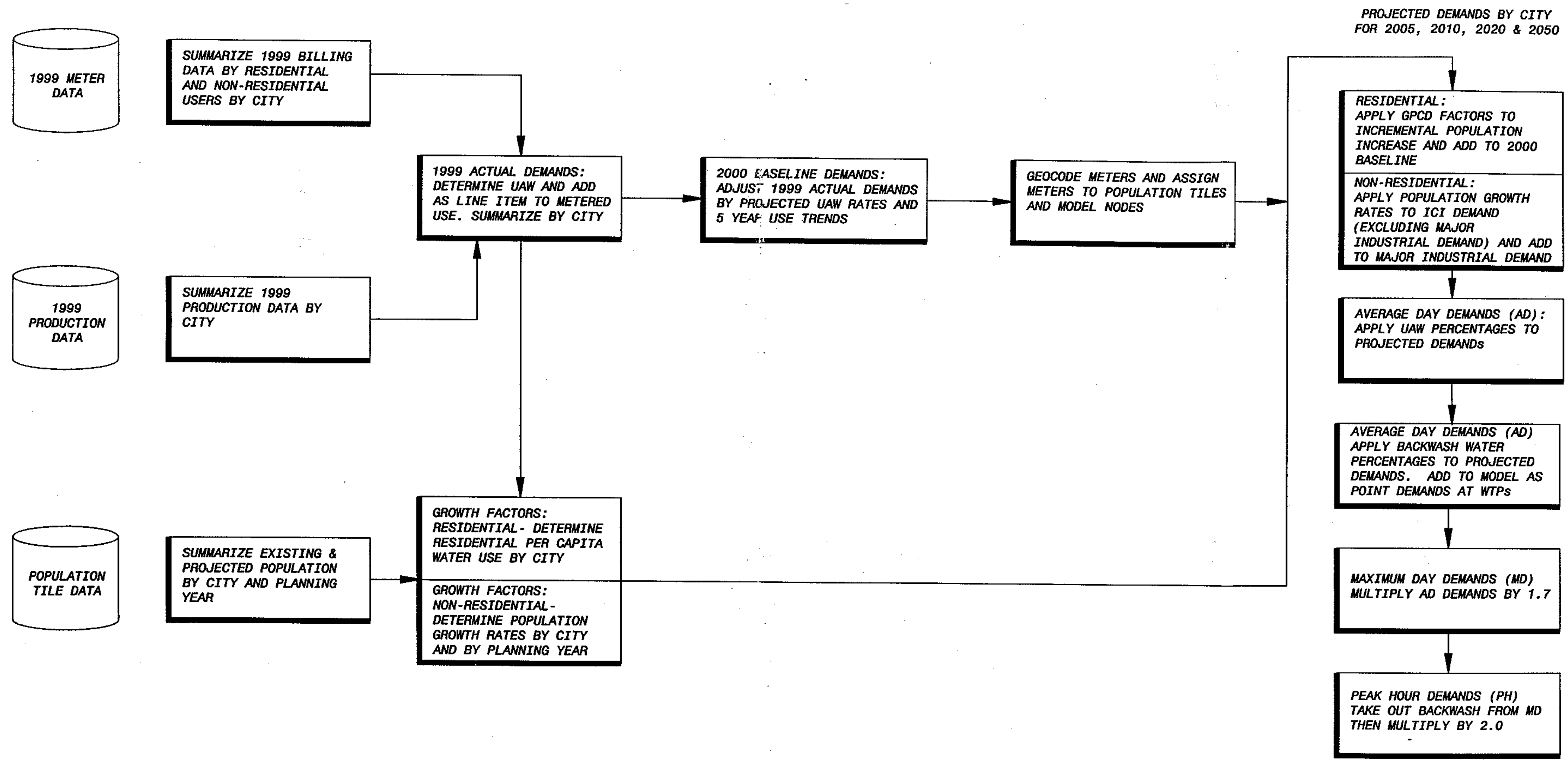
City Boundaries and Future Service Areas
Figure 3-1



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Demand Model
Allocation Methodology

Figure 3-2

The actual 1999 water use for each of the 42,730 meters was used as a starting point and adjusted by City and Town to match the baseline use. These steps and results are described below. A detailed description of the model demand allocation methodology is included in Chapter 6.

3.2.1 Population Projections by Tile

Existing and projected population figures were established, as described in Chapter 2, for each planning year by tile. There are a total of 586 tiles with 204 tiles sized 2500 feet square, 341 tiles sized 5,000 feet square, and 41 tiles sized 10,000 feet square. The smaller tiles are located in the denser city centers with the larger tiles in the less populated and rural areas of the county. The tiles and the relative population growth by planning year are shown in Figure 3-3. Full sized drawings are included in Appendix 1. Table 3-1 summarizes the current and projected population by existing city boundary and service areas. The tiles are the smallest units by which projected water demand growth will be assigned to the nodes in the hydraulic model.

Table 3-1
Water Service Areas Population Projection

Water Service Area	2000	2005	2010	2020	2050
Concord					
Existing (2000)	52,149	58,880	66,093	79,641	115,077
Growth Area C1	6,604	8,324	10,313	15,845	32,349
Growth Area CZ	2,882	4,646	6,371	10,499	27,486
PZ 841 (Midland)	4,053	6,067	8,236	12,319	23,741
Growth Area C2[1]	3,905	6,152	10,117	19,412	40,895
Subtotal	**65,688**	**80,164**	**97,225**	**133,811**	**235,643**
Kannapolis					
Existing (2000-Cabarrus)	30,906	39,886	47,183	61,249	90,757
Existing (2000-Rowan)	9,126	9,856	10,496	10,916	11,353
Subtotal	**40,032**	**49,742**	**57,679**	**72,165**	**102,110**
Growth Area K1[(1)]	4,271	6,660	9,250	16,186	33,300
Growth Area K2[(1)]	53	54	57	64	74
Growth Area K3[(1)]	98	214	347	644	841
Growth Area K4[(1)]	194	198	205	228	363
Growth Area K5[(1)]	42	52	67	111	247
Growth Area K6[(1)]	746	1,221	1,423	1,946	4452
Growth Area K7[(1)]	81	122	179	348	685
Growth Area K8[(1)]	0	0	0	0	0
Subtotal	**40,032**	**52,778**	**63,722**	**86,207**	**136,587**
Harrisburg					
Existing (2000)	3,874	4,403	4,938	6,357	9,001
Growth[(1)]	6,328	9,315	11,494	17,518	34,943
Subtotal	**3,874**	**7,390**	**10,104**	**17,547**	**37,616**
Mt. Pleasant					
PZ 807 (surrogate for present + future)	3,254	3,590	39,82	4,764	8,441
Total	**112,848**	**143,922**	**175,033**	**242,329**	**418,287**

[(1)] Year 2000 population water service is by wells for these areas and are, therefore, not counted in 2000.

3.2.2 Per Capita Water Use Factors

The existing residential water demands are projected to future years using the following equation:

Future Residential Demand = (Year 2000 Residential Baseline Demand) + (Unit Water Use Factor x Population Increase)

The unit water use factor applies to residential water use only and was derived by summing the actual residential water use, applying a water loss percentage, then dividing by the total current population. The resulting water use factors in gallons per capita per day (gcd) are presented in Table 3-2.

Table 3-2
Residential Unit Water Use Factors

Area	Unit Rate (gcd)	Year 2000 Population
Concord	85	65,688
Kannapolis	68[1]	40,032
Harrisburg	115	3,874
Mt. Pleasant	85	3,254
Total		**112,848**

[1]Kannapolis per capita water use is lower than other entities because all unaccounted-for-water absorbed in Pillowtex water use.

The gcd factor does not include unaccounted-for-water, which was added to the demands before being allocated to the model nodes. This formula was applied to the baseline demands for each geocoded meter classified as residential.

3.2.3 Industrial-Commercial-Institutional (ICI) Growth

The total ICI water demand for each city is comprised of major industrial demand and all other ICI demand. The major industrial demand was assumed to remain constant through 2050 and the remaining ICI demand was increased directly proportional to the population increase. The projection of ICI demand is illustrated in the following equation using the City of Concord as an example:

2005 ICI Demand = 2000 ICI Baseline Demand + 0.54 mgd x 2005 Population Growth Ratio

The population growth ratios were calculated for each planning year by dividing the planning year's projected population by the 2000 baseline population. The City of Concord's total 1999 metered ICI water demand was 3.59 mgd with 3.05 mgd attributed to major industries and 0.54 mgd for ICI excluding major industries. The City of Kannapolis' total 1999 ICI water demand was 5.5 mgd of which 5.05 mgd was major industrial use and 0.45 mgd for ICI excluding major users. The Pillowtex industry accounted for 5.0 mgd of the major industrial demand. Mt. Pleasant's total 1999 ICI water demand of 0.09 mgd was all non-major industrial use and was projected to increase at the same rate as the population. There was no ICI water demand attributed to Harrisburg.

This formula excludes unaccounted-for-water, which is added later. For the model demand allocation, the baseline demand for each geocoded ICI meter was calculated by the above formula. The ICI demand has not been adjusted for industries that shut down or significantly reduced water demand in 2001.

3.2.4 Demand Model Allocation

The demand model allocation methodology shown in Figure 3-2 preserved the water use characteristics of each of the approximately 42,000 meters in the study area and incorporated the projected growth within each of the individual 586 population tiles. In the growth areas, where there are large areas with no meters, the population tile centroids were used to locate the demands and spatially allocate those demands to existing and future nodes. This level of detail was achieved by calculating the residential and ICI future demand for each meter, using actual 1999 water use as a base, adding unaccounted-for-water as a percentage of the total, then allocating them to the closest model node. This methodology, coupled with the detailed hydraulic model, enables the model to be used to specify neighborhood level distribution pipeline improvements as well as the larger transmission mains.

The geocoding and spatial linkages were completed using ArcView GIS with database number processing driven by a relational database model (demand model).

3.2.5 Unaccounted-for-water

Unaccounted-for-water is defined as the difference between the water produced at the water treatment plants and the water consumed as measured at the metered services. This quantity includes water lost through pipe leaks, water used for fire fighting, construction hydrant use, hydrant flushing, water pipe breaks, and meter error must be added to the water demand projections.

Table 3-3 presents the actual unaccounted-for-water for each planning area for years when data was available. Ideally, historical records of a water system's unaccounted-for-water should be kept as far back as possible so those trends in water loss can be tracked. Generally, unaccounted-for-water as a percentage of total production will increase gradually over time reflecting the aging of the distribution and transmission pipelines unless an effective pipe renewal and replacement program is implemented.

Table 3-3

Historical Unaccounted-for-water

Planning Area	1995	1996	1997	1998	1999
Concord/Harrisburg					
Production, mgd	7.98	8.25	8.84	8.94	9.27
Consumption, mgd	-[1]	-	-	-	8.07
UFW, mgd	-	-	-	-	1.20
% UFW	-	-	-	-	12.9%
Kannapolis					
Production, mgd[2]	2.05	1.77	2.34	1.31	2.77
Consumption, mgd	1.57	1.64	2.29	1.29	2.51
UFW, mgd	0.48	0.13	0.05	0.02	0.29
% UFW	23.4%	7.3%	2.1%	1.5%	10.5%
Mt. Pleasant					
Production, mgd	0.27	0.23	0.24	0.24	0.25
Consumption, mgd	0.23	0.19	0.21	0.20	0.19
UFW, mgd	0.04	0.04	0.03	0.04	0.06
% UFW	13.9%	19.1%	13.1%	20.0%	23.9%

[1]"-" indicates data not available from entity.

[2]Pillowtex demand was only available for 1999 and a value of 5 mgd was used for the prior years in determining the residential and ICI demand. Pillowtex was removed from the UFW calculation because water losses to Pillowtex are not included in the metered Pillowtex demand.

Typical unaccounted-for-water percentages for water systems with a substantial number of older pipes, range from 10 percent to 15 percent or higher. The City of Kannapolis has a high variation of its calculated unaccounted-for-water, ranging from 1.5 percent to 23.4 percent. Because of the sparsity and large disparity of the data, an industry average unaccounted-for-water of 10 percent of production, for comparably aged water systems, was used for all of the water systems. This unaccounted-for-water was applied to the 2000 baseline and projected future demands before allocating them to the model nodes.

3.2.6 Backwash Water

Historical backwash water quantities are shown in Table 3-4 for each of the water treatment plants in the study area.

Table 3-4
Historical Backwash Water Use

Water Treatment Plant	1995	1996	1997	1998	1999
Coddle Creek WTP					
Water Pumped, mgd	3.38	3.66	4.07	4.19	4.33
Backwash, mgd	0.23	0.30	0.29	0.64	1.00
% Backwash	6.8%	8.2%	7.1%	15.3%	23%
Hillgrove WTP					
Water Pumped, mgd	5.66	4.61	4.73	4.74	5.09
Backwash, mgd	0.12	0.11	0.09	0.14	0.19
% Backwash	2.0%	2.0%	2.0%	3.0%	4.0%
Kannapolis WTP					
Water Pumped, mgd	-[1]	-	2.71	2.65	2.67
Backwash, mgd	-	-	-	-	-
% Backwash	-	-	-	-	-
Mt. Pleasant WTP					
Water Pumped, mgd	0.29	0.26	0.27	0.27	0.29
Backwash, mgd	0.03	0.02	0.03	0.03	0.03
% Backwash	9.4%	9.4%	10.5%	10.7%	11.2%

[1]"-" indicates data not available from entity.

The Coddle Creek WTP is currently being upgraded and the high backwash rate is expected to be reduced to a rate of 10 percent of total production. The Kannapolis WTP backwash rate of 8 percent of total production was based on planned water quality and process upgrades to the plant in the near future. The year 2000 production of 7.71 mgd (includes the Pillowtex demand) and a backwash of 1.73 mgd yields a current backwash rate of 22 percent.

Backwash water was applied to the model nodes as point demands at the respective water treatment plants as shown in Table 3-5 and is not included in the demand model allocation table generated from the MS Access Demand model database.

Table 3-5
Allocation of Backwash Point Water Demands

Water Treatment Plant	Model Node	Yr. 2000 Base Amount, mgd
Hillgrove WTP	647	0.5
Coddle Creek WTP	645	0.5
Kannapolis WTP	541	0.3
Mt. Pleasant WTP	53,073	0.03

Backwash water was included in the Average Day and Maximum Day demand sets but was excluded from the Peak Hour scenario because it was considered unlikely the WTPs' filters would be backwashed during the day's peak hour of demands.

3.2.7 Demand Patterns

Historical maximum day to average annual demand factors for the five year period from 1995 to 1999 are listed in Table 3-6.

Table 3-6
Historical Maximum Day Factors

Planning Area	1995	1996	1997	1998	1999
Concord/Harrisburg					
Average Day Production, mgd	7.98	8.25	8.84	8.94	9.27
Maximum Day Production, mgd	11.40	10.35	10.88	11.08	16.54
Maximum Day Peaking Factor	1.43	1.25	1.21	1.24	1.78
Kannapolis[1]					
Average Day Production, mgd	2.05	1.77	2.34	1.31	2.77
Maximum Day Production, mgd	-[2]	-	5.07	2.03	4.56
Maximum Day Peaking Factor	-	-	2.2	1.5	1.6
Mt. Pleasant					
Average Day Production, mgd	0.27	0.23	0.24	0.24	0.25
Maximum Day Production, mgd	0.53	0.47	0.48	0.41	0.49
Maximum Day Peaking Factor	1.47	1.66	1.88	1.72	1.65

[1] Excludes Pillowtex demands.
[2] "-" indicates data not available from entity.

The 1999 factors were higher than prior years due to unusually high irrigation caused by drought conditions. Although treatment plant capacities are sized on maximum day demands, measures are taken by the Cities during droughts to reduce water use and maintain a lower maximum day demand. Therefore, despite having been exceeded in the recent year, a more typical maximum day to average day factor of 1.7 will be used for this project. This also provides a standard regional criteria for sizing major treatment plant, supply pipeline, and pumping facilities.

Average day, maximum day and peak hour demand projections are detailed in Table 3-7.

The average day and maximum day water demand projections are summarized in Table 3-8.

Table 3-7
Breakout of Current and Projected Demands

Planning Area	2000	2005	2010	2020	2050
Concord/Harrisburg					
Average Day Demand	9.63	12.65	14.74	19.44	32.38
Average Day Backwash(1)(6)	1.07	1.26	1.47	1.94	2.70
Total Average Day Production	10.70	13.91	16.22	21.39	35.08
Maximum Day Demand	15.39	21.50	25.06	33.05	55.05
Maximum Day Backwash(1)(6)	17.10	2.15	2.51	2.70	2.70
Total Maximum Day Production	17.10	23.65	27.57	35.75	57.75
Peak Hour Demand(4)	30.78	43.00	50.13	66.11	110.11
Kannapolis					
Average Day Demand	3.46	4.57	5.53	7.49	11.88
Average Day Pillowtex	4.50	4.50	4.50	4.50	4.50
Average Day Backwash(2)(6)	0.64	0.73	0.80	0.96	1.20
Total Average Day Production	8.60	9.80	10.83	12.94	17.58
Maximum Day Demand	5.88	7.77	9.39	12.72	20.19
Maximum Day Pillowtex	5.00	5.00	5.00	5.00	5.00
Maximum Day Backwash(2)(6)	0.87	1.02	1.15	1.20	1.20
Total Maximum Day Production	11.75	13.79	15.54	18.92	26.39
Peak Hour Demand(4)(5)	16.76	20.54	23.79	30.45	45.38
Mt. Pleasant					
Average Day Demand	0.25	0.30	0.37	0.50	1.10
Average Day Backwash(3)(6)	0.01	0.02	0.02	0.02	0.04
Total Average Day Production	0.26	0.32	0.39	0.52	1.14
Maximum Day Demand	0.43	0.52	0.63	0.85	1.87
Maximum Day Backwash(3)(6)	0.02	0.03	0.03	0.04	0.04
Total Maximum Day Production	0.45	0.54	0.66	0.89	1.91
Peak Hour Demand(4)	0.85	1.04	1.26	1.69	3.74
Total Study Area					
Average Day Demand	17.9	22.0	25.1	31.9	49.9
Average Day Backwash	1.7	2.0	2.3	2.9	3.9
Average Day Production	19.6	24.0	27.4	34.9	53.8
Maximum Day Demand	26.7	34.8	40.1	51.6	82.1
Maximum Day Backwash	2.6	3.2	3.7	3.9	3.9
Total Maximum Day Production	29.3	38.0	43.8	55.6	86.1
Peak Hour Demand(4)	48.4	64.6	75.2	98.2	159.2

(1) The maximum backwash is equal to the 2003 Coddle Creek and Hillgrove WTP combined capacity of 27 mgd multiplied by 10% or 2.7 mgd.
(2) The maximum backwash is equal to the 2003 Kannapolis WTP capacity of 15 mgd multiplied by 8% or 0.8 mgd.
(3) The maximum backwash is equal to the 2003 Mt. Pleasant WTP capacity of 0.86 mgd multiplied by 5% or 0.04 mgd.
(4) Peak hour demands do not include backwash.
(5) Pillowtex peak hour demand equal to 5.0 mgd.
(6) Demands beyond the year 2003 WTP capacities will be met by imported treated supplies that have no backwash demand.

Table 3-8
Summary of Current and Projected Demands

Planning Area	2000	2005	2010	2020	2050
Concord/Harrisburg					
Average Day Production	10.70	13.91	16.22	21.39	35.08
Maximum Day Production	17.10	23.65	27.57	35.75	57.75
Peak Hour Demand	30.78	43.00	50.13	66.11	110.11
Kannapolis					
Average Day Production	8.60	9.80	10.83	12.94	17.58
Maximum Day Production	11.75	13.79	15.54	18.92	26.39
Peak Hour Demand	16.76	20.54	23.79	30.45	45.38
Mt. Pleasant					
Average Day Production	0.26	0.32	0.39	0.52	1.14
Maximum Day Production	0.45	0.54	0.66	0.89	1.91
Peak Hour Demand	0.85	1.04	1.26	1.69	3.74
Total Study Area					
Average Day Production	19.6	24.0	27.4	34.9	53.8
Maximum Day Production	29.3	38.0	43.8	55.6	86.1
Peak Hour Demand	48.4	64.6	75.2	98.2	159.2

(1) Average Day production includes backwash water use.
(2) Maximum Day production includes backwash water use.
(3) Peak Hour demands do not include backwash water use.